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ROLLING MILL FOR HOT ROLLING METAL, ESPECIALLY ALUMINUM, AND HOT-ROLLING METHOD

The invention concerns a rolling mill for hot rolling metal, especially aluminum, with a hot-strip mill comprising a roughing train and a finish-rolling train. The invention also concerns a corresponding hot-rolling method.

The rolling of aluminum in hot-strip mills is well known. The conventional layout 100 for a hot-rolling mill of this type, an example of which is shown in Figure 3, comprises the principal processing stations of the furnace region 102, the rolling train 103, and possibly the finishing station (dressing and straightening).

An aluminum billet 117 is brought to rolling temperature in furnaces 120, 121, for example, hearth-type furnaces or pusher-type furnaces, passed through an edging stand 107, and then roughed in the single-stand roughing stand 108 of the roughing train 104. During the roughing, the roughed product is subjected to a first cropping with a first shear 122. Before

entering the finish-rolling train 105, which consists, as shown here as an example, of four stands 111, 112, 123, 124, the mill bar 119 is cropped at the beginning and end of the mill bar by the cropping shears 122, 125, which are separated by a specific distance. The strip 113 finish rolled in the finish-rolling train 105 runs along trimming shears 126 and is coiled by a coiler 114 driven by driving rolls 127.

An installation of this type with a furnace region 102 and rolling trains 103 can have an enormous overall length. For example, the length x of a furnace region 102 may be 130 m, and the distance between the roughing stand 108 and the first stand 111 of the finish-rolling train may be 240 m, and these distances affect the coil sizes that can be produced. In this regard, the rolling stock passes through the rolling mill installation with the aid of extensive conveying and guiding devices, such as roller tables. Rolling mills of this type tend to operate more economically with larger coil dimensions.

Installations with overall lengths of this size require large capital investment and a large amount of building area. Furthermore, the lengthy roller tables for conveying the rolling stock likewise require large capital investment.

Proceeding from this prior art, the objective of the

invention is to create a rolling mill with a more compact type of construction for hot rolling metal, especially aluminum, wherein the conveyance intervals between the individual processing stations (furnace region, roughing, finish rolling) are reduced. At the same time, a hot-rolling method is to be created that allows the rolling of strip to the final rolled thickness with a compact construction of the rolling mill and a high degree of economy.

These objectives are achieved by a rolling mill with the features of Claim 1 or Claim 4 and by a method with the features of Claim 7 or Claim 8. Advantageous refinements are described in the dependent claims.

The basic idea of the invention is that a compact design of the rolling mill or the hot-strip mill arises from the systematic utilization of tandem rolling in the roughing train, in the finishing train, or in the roughing train and the finishing train. The roughing train alone and/or the finishing train alone or the roughing and finishing train together are tandem trains, i.e., sections of the installation in which the rolling stands are arranged one after the other (tandem arrangement). Due to the resulting compact construction, considerable parts of the otherwise necessary roller tables can

be eliminated, which results in reduced capital expenditures.

In accordance with the invention, it is proposed that the roughing train be designed as a tandem train, which can comprise two roughing stands arranged one after the other. This roughing train preferably operates as a reversing train.

The roughing train can also be a single-stand roughing train. It then operates in tandem operation with the finishing train. The distance between the roughing train and the finish-rolling train is selected in such a way that all of the stands can roll simultaneously.

In addition, it is proposed that the finish-rolling train have two coilers, and that the finish-rolling train be operated in tandem operation.

The proposed layout is not intended only for new constructions but rather is also suitable for modernization of existing installations. In particular, the tandem rolling in the roughing train and/or finishing train makes it possible for smaller installations, in which only relatively small tonnages and relatively small coils have been produced up until now, whose further processing is uneconomical in some cases, to be retrofitted in such a way that the coil weights (strip lengths) can be increased while the length of the roller tables remains

the same, so that productivity is increased.

In a preferred layout, two roughing stands are provided in the roughing train, and two finishing stands are provided in the finish-rolling train, with each train operating in tandem operation. All together, with this layout with four stands, one rolling stand can be saved compared to the conventional layout with five stands. Moreover, the two roughing stands in the new layout can be realized as cost-saving two-high stands, while the finishing stands are four-high stands.

Additional details and advantages of the invention are specified in the dependent claims and in the following description, in which the specific embodiments of the invention illustrated in the drawings are explained in greater detail.

-- Figure 1 shows the compact installation layout of the rolling mill for rolling aluminum in accordance with the invention.

-- Figure 2 shows the manner in which the rolling method of the invention is carried out in a rolling mill of the invention.

-- Figure 3 shows the installation layout of a conventional hot-strip mill for aluminum for purposes of comparison.

Figure 1 shows the new compact hot-rolling mill layout 1 for aluminum. Comparison with the prior-art layout 100 in

Figure 3 illustrates the compactness of the installation of the invention. The installation of the invention also comprises a furnace region 2 and the rolling train 3 with a roughing train 4 and a finish-rolling train 5.

A heavy cropping shear 6 and an edging stand 7 are arranged downstream of the furnace region 2. In the illustrated embodiment, the roughing stand 4 comprises two roughing stands 8, 9 arranged one after the other, which operate in reversing tandem operation. The roughing stand 4 is followed by a flying shear 10 for preparing the rolling stock for finish rolling. The finish rolling is carried out in the finish-rolling train 5, which comprises two closely arranged four-high stands 11, 12, such that the strip 13 can be rolled in a reversing operation. For this purpose, a first coiler 15 is located upstream of the finish-rolling train 5, and a second coiler 14 is located downstream of the finish-rolling train 5. A trimming shear 16 is located downstream of the first coiler 15.

Compared to the previously known installation, the overall length of the installation of the invention in Figure 1 is significantly shorter, especially where the distance between the end of the roughing train 4 and the first stand 11 of the finish-rolling train 5 is concerned. The proposed installation

is very compact, and at the same time, it is possible to produce high coil weights. Compared to the conventional installation (Figure 3), only a flying shear 10 is additionally installed between the roughing train 4 and the finish-rolling train 5.

The method itself is illustrated in Figure 2. To carry out the hot-rolling operation, a hot aluminum billet 17 is placed on a roller table 18 and carried into the tandem roughing train 4, where it is rolled out in a tandem reversing operation in the two roughing stands 8, 9, for example, three times back and forth, as indicated by the arrows a and designated as rolling step I. The tail end of the strip is subjected to a first cropping by the heavy cropping shear 6. After a sufficient number of reversing operations have been carried out, the mill bar 19 that is obtained can now be conveyed directly into the finish-rolling stand 5 with the simultaneous participation of all of the stands. Accordingly, a tandem operation takes place in all of the stands of the roughing train and the finish-rolling train. The mill bar 19 is finish rolled into strip 13 by tandem rolling in stands 11, 12 of the finish-rolling train 5 (rolling step II).

In accordance with another variant of the method (IIb), the roughed product is rolled out in the finishing stands 11, 12 by

tandem reversing rolling between the two coilers 14, 15. After the first rolling operation with simultaneous participation of the two finishing stands 11, 12, the strip 13 is coiled with the second coiler 14. The tail end of the strip is cropped with a flying shear 10. The direction of rotation of the upper and lower rolls of the stands 11, 12 is then reversed (arrow b), and the strip 13 is drawn back into the finishing stands 11, 12. The strip 13 is coiled by the first coiler 15 and simultaneously uncoiled from the second coiler 14, and then the direction is reversed again (arrow c). The reversing operation can be repeated according to the desired final thickness of the strip 13.

The use of tandem rolling in a hot-strip mill for aluminum makes it possible to achieve a significant increase in the productivity and economy of compact plants that previously operated uneconomically.

List of Reference Numbers

1	hot-rolling mill layout
2	furnace region
3	rolling train or hot-strip mill
4	roughing train
5	finish-rolling train
6	heavy cropping shear
7	edging stand
8	roughing stand, two-high stand
9	roughing stand, two-high stand
10	flying shear
11	finish-rolling stand, four-high stand
12	finish-rolling stand, four-high stand
13	strip
14	second coiler
15	first coiler
16	trimming shear
17	billet, initial product
18	roller table
19	mill bar, roughed product

100	conventional hot-rolling mill layout
102	furnace region
103	rolling train
104	roughing train
105	finish-rolling train
107	edging stand
108	roughing stand
111-112	stands
113	strip
114	coiler
117	aluminum billet
119	mill bar
120	furnace
121	furnace
122	cropping shear
123	stand
124	stand
125	light cropping shear
126	trimming shears
127	driving rolls

x, y, z	distances
a, b, c	arrows
I	roughing in tandem operation
II	roughing in tandem operation with all stands
IIa	reversing finish rolling in tandem operation between two coilers